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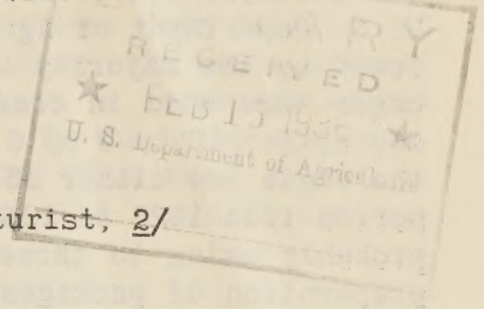
December 1935

1.9.5
Em 8615

United States Department of Agriculture
Bureau of Entomology and Plant Quarantine

THE SHIPPING OF PACKAGE BEES 1/

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The package-shipping industry began in the early eighties when A. I. Root, of Medina, Ohio, first shipped small screened cages containing one-half to 1 pound of bees. The bees were shipped with candy food and the cages were supplied with water feeders in most cases. This method of shipping bees attracted much attention, but the losses in shipment were large and the practice was soon abandoned.

During the World War commercial beekeeping received a great impetus, and with the increase of commercial honey production in the Northern States there came a demand for package bees from the South to be used to replace winter losses in the North or for increasing the number of producing colonies. The commercial bee-shipping industry really dates from about 1913 and made very rapid strides from that time until 1921, when a peculiar set of conditions brought about a lowering of the price for bees with a consequent decrease in the number of shippers.

Throughout the period from 1913 to 1918 a large proportion of the bees were shipped on candy food. Owing to several factors, perhaps chiefly because of the cost and lack of uniformity of the candy, the practice of shipping bees on candy decreased in favor, and in 1928 only one commercial shipper was using candy as a shipping food. Today practically all packages are shipped on a liquid food composed of approximately equal parts of granulated sugar and water.

In 1928 and, although accurate figures are not available, probably prior to that time, losses in shipments of bees averaged from 10 to 15 percent of all the bees shipped in packages. At that time a survey of shipping practices in

1/ Data taken from a report covering the experimental shipments of bees made under the cooperative agreement between the Railway Express Agency and the United States Department of Agriculture. Contribution from the Southern States Bee Culture Field Laboratory, University Station, Baton Rouge, La.

2/ The writer wishes to express his sincere appreciation of the cooperation, courtesy, and information so freely given by the officials, agents, and messengers of the Railway Express Agency, without which this work would have been impossible.

3/ The Southern States Field Laboratory of the Division of Bee Culture of the Bureau of Entomology and Plant Quarantine is located at Baton Rouge, La., and is maintained cooperatively by the Louisiana State University and the United States Department of Agriculture.

the Southern States showed that about 80 different sizes, shapes, and designs of cages were being used for commercial shipments. In 1931 a multigraphed circular, E-287, "Recommendations for Shipping Cages for Bees", was issued by the Southern States Bee Culture Field Laboratory of the Bureau of Entomology, U. S. Department of Agriculture, and the recommendations were so closely followed by the majority of shippers that in 1933 practically only two types of cages were used in commercial shipments. For the 2-pound packages the cages are either 12 by 9 by 6 or 16 by 9 by 4½ inches, and for the 3-pound packages the cages are either 15 by 9 by 6 inches or 16 by 9 by 5½ inches. During the period from 1928 to 1933 the loss in shipment dropped to less than 1 percent, probably owing to three factors, the adoption of more standard cages, better preparation of packages by shippers, and better handling by common carriers.

The package-shipping industry has kept pace with the expansion of the commercial honey-producing industry and has grown from practically nothing in 1913 to a business requiring the full attention of nearly 200 commercial shippers. The following tabulation showing the volume of business during 1932 and 1933 is probably more accurate than any previous tabulation.

<u>Year</u>	<u>Packages shipped</u>	<u>Pounds of bees shipped</u>
1932	71,843	179,608
1933	88,180	190,450
1934	108,339	257,001

The following figures, furnished by the Railway Express Agency, show the amount of claims paid by the Agency on bees shipped in 1933. The figures are for claims paid and do not represent the total loss in shipment, since many shippers do not file claims for small losses.

<u>Period</u>	<u>Number of claims</u>	<u>Total value</u>	<u>Average claim</u>
4/1 - 4/15	6	\$61.31	\$10.21
4/16 - 4/30	8	30.12	3.76
5/1 - 5/15	22	120.99	5.50
5/16 - 5/31	23	195.18	8.49
6/1 - 6/15	31	620.01	20.00
6/15 - ... 1/	19	623.83	32.83

From this tabulation it is evident that the number of claims per half-month increased as the season advanced, but decreased slightly at its close; it is further evident that both the total value of losses and the average cost per claim for the first half-month were moderate, that in the second half-month they dropped to the low points for the season, and that thereafter they rose steadily to the end of the period reported.

The question of loss in shipment is one that concerns not only the carrier but also the shipper and the receiver of the bees. To the carrier, loss during shipment not only entails loss in revenue, but also engenders a lack of confidence in the service rendered. This has been shown during the past two years (1933-1934) in an increasing use of trucks coming from the honey-producing areas to the South and returning with loads of bees. In spite of express

1/ Last shipment claim on July 24.

rates being considerably lower than in the past, the trucking practice is satisfactory to the honey producer, since he personally supervises the transportation of the bees. This practice will be more satisfactory if he can develop a honey market in the South that will permit him to make use of his truck on the southward trip. To the shipper, who guarantees safe delivery of bees to destination, the loss during shipment means sending more bees, perhaps during a rush period when all of his time should be given to regularly booked orders, and in many cases means the loss of a customer. To the honey producer, loss in shipment means the loss of at least two weeks when bees should be building up to colony strength for a honey flow, and, if replacements are delayed, it may mean the total loss of a crop of honey.

In many ways the Railway Express Agency, with its far-reaching facilities, furnishes an ideal service for the shipping of bees. Trucks, with their personally interested attendants versed in methods of handling bees, may be able under adverse conditions to deliver bees in better condition, but the irregularity of schedule and the necessity for the shipper to prepare larger orders on short notice does not make this method of shipment particularly attractive to the shipper. Small orders are sent by mail, particularly to those places not served by other common carriers, but the vast majority of bee shipments are still carried by express.

During 1933 and 1934 losses in shipments of bees by express reached a high point similar to the losses prior to 1930. These losses were not confined to any one important express route or to any specific group of shippers or method of shipment. During April 1934 the writer was able to spend nearly three weeks in travel by automobile through the States of Louisiana, Mississippi, Alabama, and Georgia for a study of shipping methods. In most cases shippers are preparing bees in better shape for shipment, and with greater uniformity, than was observed on a similar trip in 1929.

The period from June 11 to July 19, 1934, was largely spent in travel with experimental shipments of bees from Natchez, Miss., to Lansing, Mich., to Hallock, Minn., and to Alice, N. Dak. Twenty 2-pound packages of bees were used in each shipment. These shipments allow some interesting conclusions to be drawn.

RESULTS OF EXPERIMENTAL SHIPMENTS

Handling by express messengers

The express messenger is a busy man even when shipments of bees are not heavy. It is his duty to receive shipments at receiving points, to keep accurate record of all shipments, to deposit shipments at destination, and to keep the shipments in his care in good condition. Messengers are interested in bees and, in my experience, give them as good attention as their information permits.

The diagram in figure 1 shows the average express car, with the heavy arrow indicating the direction of travel and the letters A, B, C, D, E, and F indicating the various loading areas within the car. In the diagram the doors in the sides of the car are shown open while those in the ends of the car are closed.

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Spaces A, B, C, and D are suitable for bees, since they are well ventilated with the exception of the rear corners of the car. Spaces E and F are never well ventilated and bees are not carried there. Spaces A and B are usually occupied by the express messenger and the equipment necessary for his work, so that little of this space is available for bee shipments. Spaces C and D therefore are the best and most frequently used areas for package-bee shipments.

In these areas, C and D, the express messenger must stack all the package bees received on his particular run. Perhaps no two shipments are crated alike or in the same size packages, but the messenger is responsible for providing this miscellaneous assortment with adequate ventilation. In addition to this, at the end of his run, the messenger turns the bees over to a second messenger, who must check shipping point, waybill number, and destination on each shipment and rearrange the shipments to best advantage for unloading. Under such conditions the express messenger is doing a very creditable job of carrying bees safely to destination.

Effect of the sun

Sun will kill bees; however, the death of package bees exposed to the sun is not caused by the effect of the sun's rays but by the high temperature which this exposure causes within the package. Under normal conditions of temperature and ventilation the honeybee spends a good part of its active life fully exposed to the action of the sun. When bees are caged, however, there is less ventilation and more nervousness and activity. As the temperature rises, from exposure to sun, the activity within the package increases, and with the increase in activity there is a corresponding rise in the temperature within the package due to the increased activity. Unless there is adequate ventilation to carry off the excess heat, a package of bees may die within 30 minutes. However, the sun is merely an activating agent and not a killing agent.

No losses occur to packages of bees exposed to the sun if given adequate ventilation, as was shown in the experimental cages exposed to sun for periods of 5 to 7 hours. There is seldom any loss from sun when a single package of bees is exposed, but when a truck load of bees is exposed, even for a short period, there is a likelihood that those packages which are cut off from ventilation by surrounding packages may die rapidly from high temperatures plus poor ventilation even though the direct rays of the sun cannot penetrate to them.

Effect of high temperature

Bees in a screened cage, either with or without a queen, are always more nervous and exhibit more activity than similar bees on combs. Activity with bees generates heat, and in a screened cage this heat is generated rapidly. High temperature, that is, a temperature ranging from 85° to 105° F., tends to increase the activity of bees and this activity in turn further raises the temperature and also increases the consumption of food. At temperatures of 70° F. or less, with adequate ventilation, package bees will be quiet and loosely

clustered, and this condition is maintained unless temperatures below 50° F. are encountered. Such low temperatures would be rarely found in an express car but might be encountered at transfer points. Even at transfer points, if a large shipment was being handled, the heat generated by the bees would tend to keep the cage temperatures considerably higher than the surrounding temperature. It must be remembered that bees can stand low temperatures during shipment much better than they can stand high temperatures.

Effect of ventilation

As stated above, the effect of high temperatures can be offset by adequate ventilation. The crowding of bees in screened cages tends to cut down the free movement of air. During the hot weather, or when for any reason the bees are active within the cage, free circulation of air is necessary to carry off the heat and to prevent it from accumulating within the cage. Bees can survive with very little ventilation when the temperatures are low, as shown in shipments when normal ventilation was cut off by surrounding express shipments. However, when bees are exposed to sun with the accompanying high temperatures, ventilation is extremely important, as shown by the fact that the bees in the center cages in a crate died when exposed to sun while those in the better ventilated end cages of the crate survived.

In large shipments, with carload lots, or when cars are heavily loaded with other express shipments, the ventilation of the car is poor even with all the doors open. In such cases those packages located at the bottom of the stack and near the side walls of the car fail to receive adequate ventilation, high temperatures result, and the bees die.

Effect of ice

In tests with package bees surrounded with cakes of ice the bees were quietly clustered during the entire period even though ventilation was apparently cut off. There was apparently no ill effect when the bees were brought back to normal car temperature. Temperatures between cakes of ice were from 52° to 60° F., but the temperatures between cages in the crate were from 76° to 82° F. Consumption of food under such conditions was low.

Effect of water feeding

Practically all express cars are equipped with ice-water dispensers, and ice water was used whenever bees were given water. The crate was placed on end and the ice water drizzled slowly through the screen. Usually two cups of water were given, and within five minutes the bees would be quiet and closely clustered. The effect of giving water was the same as lowering the temperature and probably served no other purpose. Messengers on the St. Paul division carry either brushes or spray guns for giving the bees water, and it seems likely that a more common use of water would be beneficial so far as quieting the bees is concerned.

HOW THE SHIPPER CAN HELP PREVENT LOSS IN SHIPMENT

Most shippers deliver their packages to the express office in good condition so far as the bees are concerned, but in many cases there is much to be desired from the shipping standpoint. In other words, the shipper puts up a good package which would probably arrive safely at destination if it were shipped alone, but it may be a poor package when shipped in a car with other shipments. There has been remarkable uniformity of package sizes and types for the past two years, but there is less uniformity of crating methods. The average shipper has studied his own business thoroughly, but he has given much less attention to the effect that other shipments may have on his bees.

Effect of screen

Two types of cages are now being used, those screened on two sides and those screened on four sides. Under most conditions there is little choice between the two types so far as shipping is concerned, but during periods of extremely high temperatures or under conditions such as have been prevalent throughout the Middle Western States for the past two years there may be a distinct advantage in using the cage screened on four sides. With an increase of temperature above 70° F., under normal ventilation, bees tend to leave the center of the cage and to hang on the screen. Under such conditions the cage screened on four sides offers more cluster space and consequently allows better ventilation.

Effect of cluster strips

In 1929 some experimental shipments showed that cluster strips, whether of wood or of screen, were of no value during shipment. The experimental shipments of 1934 and the limited observation of commercial shipments during the same period have tended to confirm this view. Even during periods of medium temperature, when the bees were loosely clustered, there was no evidence of jarring down of the cluster in cages where no cluster strips were used. It therefore seems evident that, so far as shipments are concerned, cluster strips have little or no value.

Effect of crating

The proper and uniform crating of packages (fig. 2) is an important factor in the successful shipment of bees, especially during periods of high temperature or when ventilation is poor.

The section on crating of packages in Circular E-287, "Recommendations for Shipping Cages for Bees," has been made more definite in order to help increase the uniformity of crating. The revised recommendations are as follows:

"When two or more cages are sent to the same purchaser, they should be crated together. Four crating strips each 34 inches long by not less than 1 inch wide and three-eighths inch thick should be used on each crate. Not more than three cages should be crated together. The end cages of the crate should be placed 2 inches from the ends of the crating strips and the

center cage placed midway between the two end cages. If two cages are to be crated, the same length crating strips should be used as with the 3-cage crate, with the two cages occupying the same positions as cages 1 and 3 in the 3-cage crate. By this method all crates, whether of two or three cages, may be stacked by the express handlers and still allow plenty of ventilation. When the crating strips are allowed to project 2 inches beyond the end cages, it is impossible to place the side of the cage closer than 2 inches from the side of the express car or from other shipments.

"It is to be noted that no special provision is made for crating single packages. Any number more than three can be split into crates of twos and threes."

This means that cages will be spaced at least 6 inches apart in the crate, which will allow ample circulation of air and help to insure the safe arrival of bees at destination, even during periods of high temperature. However, with this increase in the space between packages in the recommended crate it becomes increasingly important that all shippers use the same crating methods.

Further studies of commercial shipments of bees will be made during the year 1936. It is probable, however, that high temperature and inadequate ventilation are responsible for a great portion of the losses in shipment sustained during the last two years. It is also probable that more uniform crating methods and more uniform packages will greatly reduce this loss. Shipping methods which gave good results during the period from 1930 to 1932 will perhaps still prove adequate early in the shipping season when shipments are light and temperatures likely to be low, but they are not adequate during the rush of the shipping season and during periods of high temperature. Under such conditions the shipper must package and crate his bees in such a way that they can be stacked with other shipments in the express car and still allow adequate ventilation.

control cages placed closely between the two end cages. If the cages are to be placed in the same length existing cages should be used as with the 3-cage system. By using the same cages occupying the same positions as cages 1, 2, 3 in the 3-cage system. By using the same cages, the effect of two or three cages may be obtained by the regular procedure and still allow plenty of ventilation. Then the cages are placed in the same position as cages 1, 2, 3 in the 3-cage system. It is important to place the mice at the same distance from the side of the cage as the mice in the other cages.

"It is to be noted that no special provision is made for mixing single packages and number more than three can be split into cages of four and three."

This means that cages will be spaced at least 6 inches apart in the rows which will allow ample circulation of air and help to insure the safe arrival of mice at destination, even during periods of high temperature. However, with this increase in the space between packages in the cages, it becomes increasingly important that all shipments be the same weight.

Further studies of domestic shipments of mice will be made during the year 1933. It is probable, however, that high temperature and inadequate ventilation are responsible for a great portion of the losses in shipment occurring during the last two years. It is also probable that more uniform mixing methods and more uniform packages will greatly reduce this loss. Shipping methods which have good results during the period from 1930 to 1932 will probably still prove adequate early in the shipping season when shipments are light and temperatures likely to be low, but they are inadequate during the rest of the shipping season and during periods of high temperature. Under such conditions the shipper must package and ship the mice in such a way that they can be mixed with other shipments in the express car and still allow adequate ventilation.

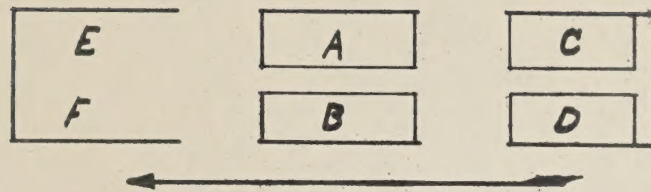


Figure 1.--Diagram for express car, showing areas (C and D) most suitable of those available for package bees.

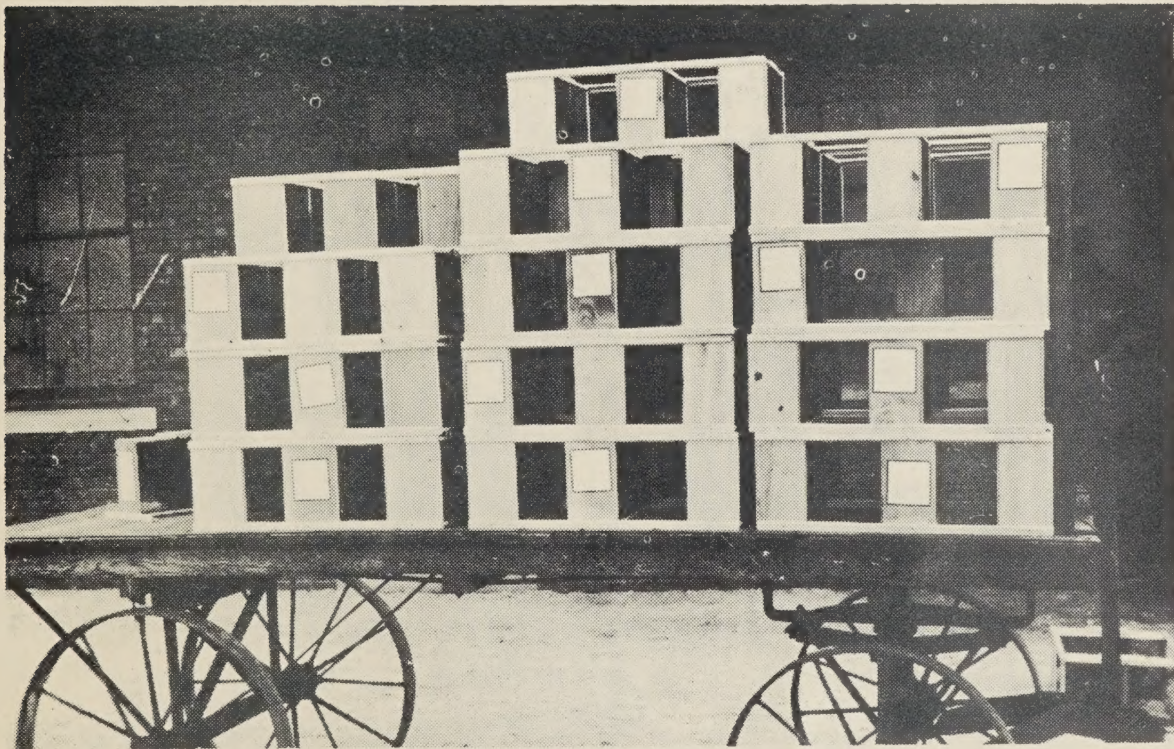


Figure 2.--Bees crated for shipment. This type of crating allows adequate ventilation.



Figure 1.—Diagram for showing
 where to put the wheels of the
 cart on the ground.



Figure 2.—How to put the wheels of the
 cart on the ground.